

Patent Application No. 10/046,295

Inventors: Lyons, et al.

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## REMARKS / ARGUMENTS

Claims 11 and 17-24 were pending and considered in the current Office Action. No Claims were allowed.

Claims 17,18, and 20 have been amended. Claim 25 has been added by this amendment. No new matter has been added by this amendment.

The examiner rejected Claims 17, 18 and 20 under 35 USC 112, second paragraph as being indefinite for failing to point out and distinctly claim the subject matter which applicant considers as the invention. The examiner states that those claims "said heating step" lack proper antecedent basis in the claims. Applicants have amended these claims to recite "said heating" rather than "said heating step". Since these claims are dependent upon Claim 11, which recites "heating" as a step in the process, applicants respectfully submit that the Examiner's rejection has been overcome.

The examiner has rejected Claims 11, 17, 18, 19, 23, 24 under 35 USC 103(a) as being unpatentable over Thome '707 in view of either Nishihara '181 or the Chemical Principles reference to show a statement of fact. The examiner states that "Thome suggests the process of heating at 550° for about 8 hours a metal oxide, i.e.  $V_2O_5$ , in a flowing gas mixture of air and water vapor at the instantly claimed flow rate and then cooling the metal oxide. The metal oxide appears to have the instantly surface area; in any event the size of the article ordinarily is not a matter of invention (see cols. 5,6). Air itself contains water vapor, i.e.  $H_2O$  gas. See Nishihara, col. 2, line 23 and the Chemical Principles reference. The subject matter as a whole would have been obvious to one having ordinary skill in the art at the time of the invention was made to have selected the overlapping portion of the range disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness."

Applicants respectfully traverse. To establish a prima facie case of obviousness, "[t]here must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination." In re Oetiker, 977 F.2d

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1443, 1447 (Fed. Cir. 1992). The examiner states that "Thome suggests the process of heating at 550° for about 8 hours a metal oxide, i.e.  $V_2O_5$ , in a flowing gas mixture of air and water vapor at the instantly claimed flow rate and then cooling the metal oxide." Applicants respectfully traverse. Thome discloses a means to produce vanadium pentoxide in powder form by thermal decomposition of ammonium metavanadate with more than 10%  $NH_3$  in one processing step (col. 1, lines 3-7). Thome discloses a method of producing a pure form of  $V_2O_5$  from precursor, not a method of introducing defects in existing  $V_2O_5$  or other metal oxides for the purpose of preparing a metal oxide for use as a battery cathode with increased capacity, as the presently claimed invention does. Thome discloses the introduction of "fresh air" for the purpose of oxidizing lower valent vanadium oxides to create purer  $V_2O_5$ . Thome does not teach that this "fresh air" will introduce defects in the  $V_2O_5$  which prepares the metal oxide for use as a battery cathode with increased capacity. Rather, Thome teaches a method of preparing purer  $V_2O_5$ , which teaches against the purposefully introduced defects into the metal oxide of the present invention. Thome also requires the presence of ammonium metavanadate in the processing of its process for making  $V_2O_5$  from precursor material, which is also absent from the present invention. Therefore, Thome neither teaches or discloses or fairly suggests a method for introducing defects in  $V_2O_5$  or other metal oxides as a means to prepare the material for use as a battery cathode with increased capacity.

What Thome lacks, neither Nishihara nor the Chemical Principles reference provide. The Examiner relies on these references to provide that "Air itself contains water vapor, i.e.  $H_2O$  gas." Even if "air" was the same as the claimed combination of  $O_2$  and  $H_2O$  of the present invention, changing the "air" of Thome to the  $O_2$  and  $H_2O$  of the present invention does not result in a process for introducing defects in existing  $V_2O_5$  or other metal oxides for the purpose of preparing a metal oxide for use as a battery cathode with increased capacity, as the presently claimed invention does. Additionally, there would be no motivation for one skilled in the art to combine the teachings of Thome, which teach how to make a purer  $V_2O_5$  from precursors, with the teachings of either Nishihara or the Chemical Principles reference to arrive at the present

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invention. One skilled in the art of preparing a metal oxide for use as a battery cathode with increased capacity would not look to a method of preparing purer  $V_2O_5$  as a reference that teaches a method of introducing defects in a metal oxide for the use as a battery cathode with increased capacity. Therefore, applicants respectfully submit that the examiner's rejection of Claims 11, 17, 18, 19, 23, 24 under 35 USC 103(a) has been overcome, and respectfully request reconsideration.

The examiner has rejected Claims 11, 19, & 24 under 35 U.S.C. 103(a) as being unpatentable under Howard, Jr. '477 in view of either Nishihara '181 or the Chemical Principles reference to show a statement of fact. The examiner stated that "Howard, Jr. suggests the process of heating a metal oxide sample, eg.  $LiMn_2O_4$  in flowing air at the instantly claimed flow rate. Air contains water vapor or  $H_2O$  gas according to Nishihara or the Chemical Principles reference. The metal oxide sample appears to have the instantly claimed surface area; in any event the size of an article ordinarily is not a matter of invention."

Applicants respectfully traverse. To establish a prima facie case of obviousness, "[t]here must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination." Howard teaches an intercalation composition and a method for making such. An intercalation composition is one where a molecule (or group) is included between two other molecules (or groups). The host usually has some periodic network. Howard teaches the use of a spinel structure and the molecule included is a trivalent metal cation that adapts to the spinel structure in place of manganese. (see col 3 line 57 – col. 4 line 23). The present invention does not involve introducing a molecule (or group) between two other molecules (or groups), as in Howard. The present invention introduces vacancies into the metal oxide lattice during heating under  $O_2/H_2O$ . These vacancies prepare the metal oxide for use as a battery cathode with increased capacity without introducing an additional molecule, as required in the intercalation composition of Howard. Thus, Howard neither teaches nor discloses the present invention. What Howard is lacking is not supplied by either Nishihara nor the Chemical Principles reference provide. The

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Examiner relies on these references to provide that "Air itself contains water vapor, i.e. H<sub>2</sub>O gas." Even if "air" was the same as the claimed combination of O<sub>2</sub> and H<sub>2</sub>O of the present invention, changing the "air" of Howard to the O<sub>2</sub> and H<sub>2</sub>O of the present invention does not result in a process for introducing defects in existing V<sub>2</sub>O<sub>5</sub> or other metal oxides for the purpose of preparing a metal oxide for use as a battery cathode with increased capacity, as the presently claimed invention does. Additionally, there would be no motivation for one skilled in the art to combine the teachings of Howard, which teach how to make an intercalation composition, with the teachings of either Nishihara or the Chemical Principles reference to arrive at the present invention. Therefore, applicants respectfully submit that the examiner's rejection of Claims 11, 19, & 24 under 35 USC 103(a) has been overcome, and respectfully request reconsideration.

The examiner has rejected claims 11, 17, 19, 23, and 24 under 35 U.S.C. 103(a) as being unpatentable over Chambers '005. The examiner states that "Chambers suggests the process of heating a sample of V<sub>2</sub>O<sub>5</sub> at 500° C in a stream of air saturated with water vapor, i.e., flowing gas mixture of O<sub>2</sub> and H<sub>2</sub>O, at or overlapping the instantly claimed flow rate. See Col. 4, and example 1." Applicants respectfully traverse. Chambers teaches a method of separating vanadium from vanadium bearing material. Chambers teaches the use of raw material, such as "titanium slag" (see example 1) and extracting from it pure vanadium. Chambers neither teaches nor discloses the present invention, a process for preparing a metal oxide for a battery cathode with increased capacity. One skilled in the art of preparing a metal oxide for use as a battery cathode with increased capacity would not be motivated to use a method of extracting V<sub>2</sub>O<sub>5</sub> from raw materials as a reference a process for preparing a metal oxide for a battery cathode with increased capacity. Therefore, applicants respectfully submit that the examiner's rejection of Claims 11, 17, 19, 23, and 24 under 35 USC 103(a) has been overcome, and respectfully request reconsideration.

The examiner has rejected claims 11, 17, 18, 20-22 and 24 under 35 U.S.C. 103(a) as being unpatentable over Shizuka '637 in view of either Nishihara '181 or the Chemical Principles reference. The examiner stated "Shizuka suggests the process of heating a metal

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oxide, e.g.  $\text{Mn}_2\text{O}_3$ ,  $\text{Co}_3\text{O}_4$ , in air to  $500^\circ\text{C}$  for 6 hours at a rate of  $5^\circ\text{C}/\text{min}$  and then cooling the metal oxide to room temperature, ie. ambient, at a rate of  $5^\circ\text{C}/\text{min}$ . [...] See examples 1-4. Air contains water vapor, ie,  $\text{H}_2\text{O}$  gas. See Nishihara, Col. 2, line 23 and the Chemical Principles reference. Applicants respectfully traverse. To establish a prima facie case of obviousness, “[t]here must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination.”

Shizuka teaches an improved intercalation composition and a method for making such. An intercalation composition is one where a molecule (or group) is included between two other molecules (or groups). The host usually has some periodic network. Shizuka teaches the use of a spinel structure and the inclusion of a molecule in a bivalent or trivalent state that adapts to the spinel structure in place of manganese. (see col 3 line 3 – 14). The present invention does not involve introducing a molecule into a spinel structure as in Shizuka. The present invention introduces vacancies into the metal oxide lattice during heating under  $\text{O}_2/\text{H}_2\text{O}$ . These vacancies prepare the metal oxide for use as a battery cathode with increased capacity without introducing an additional molecule, as required in the intercalation composition of Shizuka. Thus, Shizuka neither teaches nor discloses the present invention. What Shizuka is lacking is not supplied by either Nishihara nor the Chemical Principles reference provide. The Examiner relies on these references to provide that “Air itself contains water vapor, i.e.  $\text{H}_2\text{O}$  gas.” Even if “air” was the same as the claimed combination of  $\text{O}_2$  and  $\text{H}_2\text{O}$  of the present invention, changing the “air” of Shizuka to the  $\text{O}_2$  and  $\text{H}_2\text{O}$  of the present invention does not result in a process for introducing defects in existing  $\text{V}_2\text{O}_5$  or other metal oxides for the purpose of preparing a metal oxide for use as a battery cathode with increased capacity, as the presently claimed invention does.

Additionally, there would be no motivation for one skilled in the art to combine the teachings of Shizuka with the teachings of either Nishihara or the Chemical Principles reference to arrive at the present invention. Therefore, applicants respectfully submit that the examiner’s rejection of Claims 11, 17, 18, 20-22 and 24 under 35 USC 103(a) has been overcome, and respectfully request reconsideration.

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**Conclusion**

In conclusion, Applicants respectfully submit that the Examiner's Office Action has been fully responded to Claims 11 and 17 - 25 are in condition for allowance. In the furtherance of compact prosecution, if a personal or telephone interview would help expedite matters, the Examiner is requested to contact Amy Ressing at 202-404-1558.

Kindly charge any additional fees due, or credit overpayment of fees, to Deposit Account No. 50-0281.

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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